

**IDAHO
COOPERATIVE AGENCIES'
WIRELESS INTEROPERABLE
NETWORK
(I-C-A-WIN)**

A Radio Interoperability Concept for Idaho

STATEWIDE INTEROPERABILITY EXECUTIVE COUNCIL
(SIEC)

www.siec.id.gov

JULY 2005

TABLE OF CONTENTS

Introduction.....	3
Recommendation	3
Background.....	4
Statement of Purpose.....	4
Interoperability.....	5
Terms and Definitions	6
Idaho's Status	8
Local Government Radio-Engineering Studies	9
Radio Studies.....	9
Planning to Achieve Level 5 Interoperability	11
Radio Interoperability Concept.....	11
State Level Radio System	12
County/Regional/Tribal Level Radio System.....	12
City/Local/Other Level Radio System	12
Implementation Steps and Timelines	12
Years 2005 – 2006.....	13
Years 2007 – 2010.....	14
Years 2011 – 2012.....	15
Connecting to Disparate Radio Systems	15
Conclusion and Recommendation	16
APPENDIXES	
Appendix A: Interoperability Continuum.....	17
Appendix B: Map	18
Appendix C: Resolution and Rationale.....	19
Appendix D: 700 MHz Radio Survey.....	21
Appendix E: Suggested Planning Elements for County Interoperable Emergency Communications Plans	24
Appendix F: State Agency Timeline.....	28
Appendix G: Budgetary Estimate for a Wide Area Trunking Solution	29
Appendix H: Methodology of Connecting to the 700 MHz Radio System.....	30

Introduction

Executive Order 2003-07 established the Statewide Interoperability Executive Council (SIEC) with the express charge to "...provide policy level direction and promote efficient and effective use of resources for matters related to public safety wireless radio interoperability." Further, the Council was directed to "...provide recommendations to the Governor and the Legislature, when appropriate, concerning issues related to statewide interoperable radio communications for public safety in Idaho."

As the SIEC began its work in December 2003, the following Mission and Vision Statements were created to support building an interoperable communications system for the benefit of all Idahoans.

Mission Statement:

The Statewide Interoperability Executive Council (SIEC) shall promote interagency cooperation and provide policy level direction to support efficient and effective use of resources to achieve interoperable communications.

Vision Statement:

Working together to build an interoperable public safety and public services communication system that will benefit all Idahoans.

This document conveys a recommendation from the SIEC to Idaho's public safety community to facilitate achieving the ultimate goal of a standards-based shared communications system for public safety service and support providers. This interim interoperability Concept provides strategic direction for immediate and future work toward that goal.

This Concept is based upon what is known today about interoperability, information gathered from a public safety communications assessment conducted across Idaho by the SIEC in 2004, and a feasibility study concluded in December 2004 by the Interoperable Communications Technical Assistance Program (ICTAP).

Recommendation

The SIEC is committed to its charge to promote efficient and effective use of resources for matters related to public safety wireless radio interoperability, standing ready to assist in the promotion of coordination and cooperation of a statewide interoperability goal.

To that end, the SIEC recommends that the State of Idaho and its political subdivisions begin immediate planning and implementation of a single Project 25 (P25) infrastructure to serve the communications needs of emergency responders. This network should include, but not be limited to the following:

- Leverage the State of Idaho's Microwave System investment
- Leverage the Idaho Bureau of Homeland Security's Master Site investment
- Utilize all available spectrum including the newly available 700MHz
- Build upon the Regional Network being constructed in Bannock and Bingham Counties
- Incorporate the Ada County/City of Boise 700 MHz network

- Include plans currently being developed by the counties of Canyon, Kootenai, Power and the Shoshone Bannock Tribe.

Realizing that these phases can run concurrently, the Council recommends that Idaho's public safety community immediately strive to achieve implementation of Level 3, identified as shared channels interoperability, and pursue Level 5 interoperability utilizing this phased outline.

While the SIEC is on an aggressive timeline to develop a statewide interoperability plan which will follow this concept, be assured that additional input will be gathered from as many public safety organizations as possible at the federal, state, local and tribal levels.

For more information about this document contact the SIEC Office at 208.884.7210.

Background

Statement of Purpose

The Idaho Statewide Interoperability Executive Council (SIEC), with broad representation from first response, administrative and operational agencies at all levels of government in Idaho, has drafted the following "Concept" to provide guidance in the development of interoperable communications. Information and data were collected to identify the current status and to assist in the development of a vision for the future of interoperable communications in Idaho.

Additionally, this document is designed to provide some general guidance for all levels of government regarding current implementation and future enhancements toward interoperable communications for all public safety agencies. The SIEC was tasked to provide policy level direction in the executive order and as such the SIEC is obligated to report our finding to the Governor followed by a release of the information to the public.

It should be clearly understood that this is not a detailed plan on how to engineer such a statewide system, but rather a direction and goal to move toward to accomplish more effective communications on a daily basis as well as during catastrophic events. The Concept contains some general types of actions that will be beneficial to federal, state, local and tribal levels of government if pursued and implemented. It also contains some time frames to keep us all moving in the right direction, culminating on Jan. 1, 2013 which is the target date in the Federal Communication Commission's (FCC) regulations for narrowbanding of all radios in the public safety sector. The SIEC has included some guidelines for counties to use to assess their own communications plan/capability and has provided some recommended immediate and low financial impact steps to improve the use of current systems.

One issue that continues to be misunderstood is the reference to the 700 MHz backbone system. It should be clearly understood that while 700 MHz appears to provide the most capacity and options for the system as a whole, this Concept clearly recognizes that some areas of the state and some agencies will likely continue to operate in the VHF (130-170MHz) or the UHF (400-500MHz) bands and that will be accommodated in the final statewide system as necessary.

This document recognizes that agencies at all levels of government will continue to maintain, improve and add to their radio communications systems in order to conduct daily business. It is

the hope of the SIEC that this document will encourage agencies to take the future into consideration in that process and look at how to invest their funds wisely in interoperable communications.

Finally, it should be clearly understood that this is the beginning document for a continuing process and not an end in and of itself. There are some technical components that will require further explanation and education by those involved in radio communications. The SIEC will seek wide distribution and encourage open communication with all of those impacted by this process. Many constructive ideas will be contributed back into the process as groups around our great state meet and discuss the issue of radio communications. The SIEC offers this Concept as guidance and assistance in radio communications planning.

Interoperability

Interoperability allows two entities with disparate communications equipment and/or infrastructure to communicate when required. In public safety, there are three situations where interoperability is required; (1) everyday operations, (2) first response, and (3) multi-agency taskforce operations. Everyday operations consist of any requirement to communicate with another agency on a frequent basis where as first response and multi-agency taskforce operations generally occur when emergency situations arise.

The US Department of Homeland Security's SAFECOM initiative defines five levels of interoperability designed to improve public safety response through interoperable communications. SAFECOM defines the use of talk-around and mutual aid channels as one combined level of interoperability.

- **Level 1**
Swap Radios - Swapping radios, or maintaining a cache of standby radios.
- **Level 2**
Gateway and Console Patches - Gateways retransmit across multiple frequency bands providing an interim interoperability solution as agencies move toward shared systems.
- **Level 3**
Shared Channels - Interoperability is promoted when agencies share a common frequency band and are able to agree on common channels.
- **Level 4**
Proprietary Shared Systems - a proprietary communications system (single manufacturer) in which interoperability is provided as a byproduct of system design. Radios work within their own system but don't necessarily have the capability to communicate with other systems.
- **Level 5**
Standards-based Shared Systems - a non-proprietary communications system in which interoperability is provided as a byproduct of system design, creating an optimal technology solution.

See Appendix A for a graphic display and more details about the Interoperability Continuum.

Terms and Definitions

700 MHz – Frequency band allocated by the Federal Communications Commission as additional 24 MHz of public safety spectrum in the 764-806 MHz band, which can provide for immediate capacity growth in areas not currently blocked by incumbent TV channels for public safety communication access. This band is capable of carrying both voice and data transmission.

Districts – Used as the unit of measure for this plan. Reference Appendix B of this Concept.

ERP – Effective Radiated Power is a measure of the power output of an antenna, used by stations to predict signal range, and by regulatory bureaus to limit a station's emissions.

FCC – The Federal Communications Commission (FCC) is an independent United States government agency, directly responsible to Congress. The FCC was established by the Communications Act of 1934 and is charged with regulating interstate and international communications by radio, television, wire, satellite and cable. The FCC's jurisdiction covers the 50 states, the District of Columbia, and U.S. possessions.

ICTAP – The Interoperable Communications Technical Assistance Program contracted through the Office for Domestic Preparedness, US Department of Homeland Security, to provide assistance in interoperability planning.

Interoperability – The ability of public safety service and support providers – law enforcement, firefighters, EMS, emergency management, public utilities, transportation and others – to communicate when necessary with staff from other responding agencies, and to exchange voice and/or data communications on demand and in real-time.

Interoperability Continuum – SAFECOM's Interoperability Continuum is designed to help the public safety community and local, tribal, state, and federal policy makers address critical elements for success as they plan and implement interoperability solutions. These elements include frequency of use of interoperable communications, governance, standard operating procedures, technology, training/exercises, and frequency of use (usage) of these solutions.

kHz / kilohertz – A unit of frequency equal to 1,000 hertz. Used especially as a radio-frequency unit.

Master Site / Master Site Switch – The Master site is a system that serves as a core network center for a trunked radio system. The Master site includes controllers, servers, network routing devices, management terminals and console equipment to support a wide-area 700 MHz Radio System. In addition, a Master site is a trunking controller that provides automatic switching of a mobile or portable radio between tower sites. Much like a cellular switch, it enables a user in one coverage area to communicate with a user in another area served by a different tower site or system of towers.

MHz / megahertz – One million cycles per second. Used especially as a radio-frequency unit.

Narrowband – The Federal Communications Commission's rule-making proceeding to reduce wideband channel assignments from 25 kHz, then to 12.5 kHz and finally to 6.25 kHz bandwidths.

NIMS – The National Incident Management System created by the US Department of Homeland Security in order to provide a consistent nation-wide approach for all levels of government to work together effectively and efficiently to prepare for, prevent, respond to, and recover from domestic incidents, regardless of cause, size, or complexity.

Project 25 Digital Radio Standards (P25) – Developed as a partnership involving the Association of Public Safety Communication Officials, the National Association of State Telecommunications Directors, agencies of the Federal government, and the Telecommunications Industry Association, Project 25 is a suite of standards for Private Wireless radio equipment. Developed in a process controlled by the public safety user community, the suite includes the air interface, and standardized functions and protocols supporting both conventional and trunking architectures. The standards require equipment to be backward compatible with legacy analog equipment (i.e., operate on both digital and analog systems) and to be non-proprietary. Ultimately, the standard ensures that all the defined services are accessible to any subscriber unit or system built to the Project 25 specifications.

SAFECOM – The Wireless Public SAFETY Interoperable COMMunications Program is the umbrella organization managed by the US Department of Homeland Security with coordination/oversight responsibility for federal initiatives and projects pertaining to public safety communications and interoperability at the local, state, federal and tribal levels.

SIEC – The Statewide Interoperability Executive Council for the state of Idaho is charged with the responsibility to provide policy level direction and promote efficient and effective use of resources for matters related to public safety wireless radio interoperability. The SIEC works in cooperation with the Idaho Emergency Communications Commission (E911 Commission) whose primary focus is to assist emergency communications and response professionals in the establishment, management, operations, and accountability of consolidated emergency communications systems.

Standards-based shared communications system – A non-proprietary communications system in which interoperability is provided as a byproduct of system design, creating an optimal technology solution.

State Level Radio Systems – Consists of a statewide digital microwave system, which is utilized by the State Agencies as a transport mechanism for the control of the state's two-way radio systems. In addition to the microwave system are the State Agencies two-way radio systems. The statewide digital microwave system is intended to link all of the state radio systems, disparate regional radio systems and other radio systems together.

Trunked Radio System – Trunking is the efficient utilization of a frequency spectrum. Many subscribers can use fewer radio frequencies than a conventional radio system to hold many conversations.

UHF – Ultra High Frequency. A band of radio frequencies from 300 to 3,000 MHz. The specific radio frequency spectrum that Idaho predominately utilizes within the 450-460 MHz range.

VHF – Very High Frequency. A band of radio frequencies falling between 30 and 300 MHz. The specific radio frequency spectrum that Idaho predominately utilizes within the 130-174 MHz range.

Idaho's Status

The public safety communications assessment conducted by the SIEC across Idaho in 2004 contained some key findings regarding public safety's ability to communicate in day-to-day operations and during catastrophic events. The most significant of these findings was the use of disparate frequencies by federal, state, local and tribal agencies coupled with topographical challenges. The following is a snapshot of some variables to consider in designing an interoperable communications system:

UHF	VHF	UHF AND VHF
<ul style="list-style-type: none">• 2 fire service districts• 86 local police departments• 31 county sheriffs offices• Idaho State Police• Idaho Transportation Department	<ul style="list-style-type: none">• 170 fire service districts• 2 local police departments• 13 county sheriffs offices• 60 EMS providers• 1 tribal government• State lands• State correctional facilities	<ul style="list-style-type: none">• 3 tribal governments• Federal government

In addition:

- many local emergency service providers have interoperability problems within their own jurisdictions, particularly in mutual aid response from surrounding counties; and
- much of the State of Idaho is mountainous terrain, causing a multitude of challenges for radio communication; and
- much of the land in Idaho is federally managed and developing new communication sites is more challenging in environmentally sensitive parts of the state.

Coupled with these internal challenges are the external challenges that will affect public safety communications in Idaho. The most significant is the FCC's mandated migration to narrow banding (12.5 kHz) for public safety by January 1, 2013.

Presently, public safety systems within Idaho generally fall into one or more of the levels from Level 1 to Level 3.

The State of Idaho microwave system has been undergoing an upgrade to digital operation over the last 10-years and is nearing completion with the final leg from Idaho Falls to Salmon projected to be complete in the summer of 2005. This upgrade was funded by contributions from the private sector and appropriations from the state legislature. Idaho's microwave system is one of the largest of its kind in the lower 48 states, covering 1,200 miles and connecting over 100 two-way radio repeater sites in some of the most remote locations in the state. The microwave system serves public safety operations, state agencies and supports digital broadcasting for Idaho Public Television. The State of Idaho digital microwave system will ensure that connectivity for all public safety interoperable communications systems may be accommodated.

In looking to the future of communications for public safety, the SIEC examined the feasibility of accessing the open 700 MHz spectrum for voice and data transmission. This spectrum has been made available by the FCC for exclusive use by public safety agencies. Initial findings indicate that a 700 MHz backbone for Idaho will allow greater interoperability capacity. Reference Appendix C of this Concept.

Local Government Radio-Engineering Studies

Many radio studies have been completed in Idaho in an attempt to solve radio coverage, frequency compatibility, and interoperability issues. Some counties in the state have completed radio design studies concerning interoperability, and many more counties are in the process of contracting for radio design studies. One Tribal Government has an engineering study in process.

The SIEC recognizes that some agencies may elect to remain in the UHF or VHF frequency bands. A system developed using 700 MHz will accommodate those agencies and allow them to share in the benefits of a statewide system. The choice to participate belongs to each agency, however all agencies are encouraged to participate in the 700 MHz interoperable radio system.

The SIEC is aware that the following jurisdictions have either completed radio-engineering studies or have contracted to have 700 MHz studies conducted. In some cases, county projects are in the construction phase. It is understood that this is an on-going process, and as such, this list is not intended to be comprehensive:

- Ada County
- Bannock County
- Bingham County
- Boise County
- Bonner County
- Boundary County
- Canyon County
- Kootenai County
- Power County
- Shoshone-Bannock Tribes

Contact these jurisdictions for information about their respective engineering studies and projects.

Radio Studies

ICTAP was asked by the SIEC to provide technical assistance to determine the feasibility of a 700 MHz statewide communication system. Reference Appendix D of this Concept.

This system will facilitate communications for tribal, federal, state, and local agencies throughout the state of Idaho.

ICTAP used districts as reference points in their study. Reference Appendix B of this Concept.

In Phase 1 of this project, ICTAP visited and evaluated forty-nine sites throughout the state. The site surveys from the visits provide detailed information about the current status of each site, including the site's interior, exterior, and tower descriptions, and a single site coverage summary at the 700 MHz and UHF frequency bands.

The ICTAP report includes a combined coverage footprint comparison, interoperability approach, a statewide system comparison, and a recommendation section. The coverage and interoperability solutions are geared toward the needs of each agency in the individual districts throughout the state. The tradeoffs and recommendation sections refer to the entire state.

ICTAP completed a feasibility study for the state in December of 2004. The ICTAP feasibility study showed the following facts:

Advantages:

VHF

- largest coverage area with fewer sites.

UHF

- larger coverage area than 700 MHz.

700 MHz

- ability to transmit and receive high rate data.
- ability to obtain 700 MHz frequencies.
- complies with the FCC's narrow banding requirements.

Disadvantages:

VHF

- limited availability of clear new frequencies.
- needs to be narrow banded.
- reduced maximum ERP requirements.

UHF

- limited availability of clear new frequencies.
- needs to be narrow banded.
- reduced maximum ERP requirements.

700 MHz

- smaller coverage area than VHF and UHF, consequently more communication sites may be developed for the same radio coverage enjoyed today.

In addition to those items discussed above, the following items identified by the SIEC Technical Subcommittee need to be considered:

Advantages:

700 MHz

- little or no noise floor.
- use of tower top amps and proper engineering should negate the disadvantage above.
- no interference, this is a clean spectrum.
- building penetration may be improved.

Disadvantages:

VHF

- cost to narrowband twice (once to 12.5 kHz, once to 6.25 kHz).

UHF

- cost to narrowband twice (once to 12.5 kHz, once to 6.25 kHz).

700 MHz

- cost of system to add sites and higher base equipment costs.

Planning to Achieve Level 5 Interoperability

Achieving Level 5 interoperability will be a long-term process requiring a phased approach.

Phase One: Attainment of Level 3 shared channels interoperability, the use of gateways and console patches for interoperable communications statewide to be completed by December 2005.

The SIEC Technical Subcommittee estimates that at least 80% of local agencies are, at a minimum, capable of achieving Level 3 communications within their particular area of operation.

In Phase One, the SIEC will encourage each county to develop a county interoperable emergency communications plan. Reference Appendix E of this Concept. These plans should make use of existing capabilities such as the ability to “patch” channels together in a dispatch console. The county interoperable emergency communications plan should be adaptable to use in the NIMS Incident Command System.

Counties are also encouraged to consider regional or multi-county system needs. The Idaho Bureau of Homeland Security will foster regional and statewide planning to help achieve this level of interoperability.

Phase Two: Analyze the results from Phase One to identify additional capabilities needed and advancements in technology and standards to determine the next steps toward Level 5 interoperability statewide to be completed by December 2006.

Phase Three: Statewide availability of Level 5 interoperability to be completed by December 2012.

Radio Interoperability Concept

This Radio Interoperability Concept presents several ideas and proposals for future direction, refinement and implementation. The Radio Interoperability Concept addresses dates/times and implementation strategies including funding mechanisms. The Concept provides a path to statewide interoperability by December 31, 2012.

The SIEC is developing a tiered radio interoperability system concept to provide a statewide standard for radio communications. Under this standard both new and existing radio systems

can be designed to tie into the statewide communications network. Details will be available in future collaboratively-authored documents.

State Level Radio System

The State Level Radio System includes both the existing statewide microwave radio system and the state agencies' radio systems. The statewide microwave system was originally funded through the Idaho Legislature and was intended to provide remote control of the state agencies' radio systems. Additionally, the statewide microwave system will provide an avenue to link disparate and unique radio systems together. The digital microwave radio system may be upgraded and expanded as the need arises.

County/Regional/Tribal Level Radio Systems

The County/Regional/Tribal Level Radio Systems are the regional radio systems throughout the state. Regional systems are intended to connect the local radio systems together, link to the State Level Radio System and enhance the State Level Radio System on a regional basis. Most counties in Idaho dispatch for all emergency medical services, fire departments and districts, and law enforcement agencies in their respective regions.

City/Local/Other Level Radio System

The City/Local/Other Level Radio Systems are very specialized local radio systems. These systems may connect the users to regional radio systems. By using the County/Regional/Tribal Level and City/Local/Other Level Radio Systems approach, those users with systems capable of Project 25 (P25) Digital Radio Standards can be provided interoperability with other users in the state. While Project 25 digital radios cannot talk directly (without infrastructure) to Project 25 digital radios in any other frequency band than the one they are operating in, it is possible to interconnect subsystems in different bands through the Master Site Switch providing common interoperability talkgroups that are band-transparent to the user. As an example, the Utah Communications Area Network (UCAN) has just added a VHF Project 25 zone to its larger 800 MHz wide area system.

Implementation Steps and Timelines

SAFECOM states in the Interoperability Continuum Overview, "an interoperability program should include both short- and long-term solutions. Early successes can help motivate regions to tackle more time-consuming and difficult challenges. It is critical, however, that short-term solutions not inappropriately drive the planning process, but function in support of longer-term improvements."¹

From the study completed by ICTAP in December 2004, the following recommendation was given:

"ICTAP recommends a phased approach for the state of Idaho's statewide interoperable radio communications strategy. A [Level 5] statewide VHF, UHF, or 700 MHz communication system, along with lower levels of interoperability, will satisfy this recommendation."²

The SIEC will proceed with ICTAP's recommendations.

¹ SAFECOM Interoperability Continuum, pg. 2, from <http://www.safecomprogram.gov>

² ICTAP's 700MHz Feasibility Study conducted for the Statewide Interoperability Executive Council, December 2004

First, the SIEC recommends that those agencies currently unable to share channels or have audio patching, try to reach that goal.

Second, the SIEC will provide guidance and assistance in reaching statewide interoperability through a standards based shared system, such as Project 25. Outlined in Appendix E are recommended steps that counties may follow when creating an interoperable emergency communications plan.

The January 1, 2013 date is a deadline established by the FCC for the first step in narrowbanding of the VHF and UHF radio frequency bands. The narrowbanding of the UHF and VHF radio frequencies does not affect the 700 MHz frequency band.

The following depicts a sequence of events looking into the future based upon what is known today about the migration to increase public safety communications interoperability in Idaho. These timelines are intended as recommended actions in this migration, are dynamic in nature, and bring the ICTAP recommendation into reality before January 1, 2013.

In Years 2005 – 2006:

State Level

The Idaho Department of Administration administers and maintains the microwave backbone for the state. The Department is researching the throughput necessary to support state and local agencies communications links. The Idaho State Police (ISP) will be installing 700 MHz data radio communications in many of their patrol vehicles.

Some state agencies in Districts 1, 3, and 5 will be testing the 700 MHz radio systems that the County/Regional/Tribal Level and City/Local/Other Level agencies will be installing. Using information gathered in this process, those agencies performing the testing will develop a conceptual communications design document for each of the six Districts. A scope of work unique to each district will be completed. A Gantt chart showing the timeline for the six Districts is included in Appendix F of this Concept.

The Idaho Emergency Communications Commission³ will conduct a survey of all dispatch centers/Public Safety Answering Points (PSAPs)⁴ throughout Idaho inquiring about their E911⁵ practices and capabilities. Information concerning consoles, radio patching, and gateways will be requested. This information will be provided to the SIEC.

County/Regional/Tribal Level

The Idaho Bureau of Homeland Security provided a grant to Ada County to procure and install a Master Site Switch to be installed at the ISP campus in Meridian. Installation should occur in calendar year 2005. This Switch will serve as a core network center for the entire trunked radio system. Audio from the many subsystems will route through and be processed from this

³ **Idaho Emergency Communications Commission (IECC)** – Established to determine the status and operability of consolidated emergency communications systems statewide; the needs for the upgrade; costs for the upgrades; recommend guidelines and standards for operation of consolidated emergency communications systems; recommend funding, serve as a conduit for the future allocation of federal grant funds, report annually to the legislature, enter into contracts as necessary, promulgate rules.

⁴ **Public Safety Answering Points (PSAPs)** – a secure location with equipment and trained personnel to answer 911 calls.

⁵ **Wireless E9-1-1 – Wireless Enhanced 9-1-1**. The wireless E911 program is divided into two parts - Phase I and Phase II. Phase I requires carriers, upon appropriate request by a local Public Safety Answering Point (PSAP), to report the telephone number of a wireless 911 caller and the location of the antenna that received the call. Phase II requires wireless carriers to provide far more precise location information, within 50 to 300 meters in most cases.

network center. The Master Site Switch will contain core network equipment (controllers, servers, network routing devices, management terminals) and console equipment to support the wide-area 700 MHz Radio System. Microwave and / or optical fiber T1 links will originate from the Master Site Switch and interface to the radio subsystems and each console dispatch location.

Ada, Bannock, and Bingham Counties have received radio engineering studies concluding that the coverage area of a Project 25, 700 MHz trunked radio system will be approximately the same or better than their existing radio systems. Ada, Bannock, and Bingham Counties will install Project 25, 700 MHz trunked radio systems in calendar year 2005.

These county radio systems will supply 700 MHz radio interoperable communications serving over 40 percent of Idaho's population.

Counties, regions and tribes are in the process of purchasing 700 MHz radio-engineering studies.

More than 80 percent of the regional radio systems will have reached Level 3 interoperability. Those regional systems that have not, will continue moving toward Level 3. Some regional systems will explore achieving Level 5 interoperability.

City/Local/Other Level

The City of Sandpoint will install a Project 25, 700 MHz trunked radio system.

SIEC research will identify those local systems not capable of Level 3 interoperability. Localized radio systems not Level 3 compliant will research achieving this status of interoperability or higher no later than December 2006.

By the end of 2006, it is estimated that 43.30 percent of Idaho's population will be served by communications interoperability through the Project 25, 700 MHz radio system.

In Years 2007 – 2010:

State Level

The Idaho Department of Administration continues research on the throughput necessary to support state and local agencies communications links and coordinates with agencies attaching to the Master Site Switch in Meridian. Some state agencies in Districts 1, 3, and 5 will have completed installation of radio equipment on their respective sites.

County/Regional/Tribal Level

Regional systems will continue moving toward Level 3 interoperability and will continue to request radio engineering studies.

Those regions with completed radio engineering studies will begin the budget, procurement, and installation cycle. Reference Appendix G of this Concept. As the regional system is brought on-line, coordination with The Idaho Department of Administration to attach the regional system to the Master Site Switch will be finalized.

By the end of 2010, it is estimated that more than 90 percent of the regional systems will have reached Level 3 interoperability.

City/Local/Other Level

The SIEC will continue to recommend that local public safety systems request radio engineering studies as needed. Those cities with completed radio engineering studies will begin the budget, procurement, and installation cycle. As a city's system is brought on-line, coordination with the Idaho Department of Administration to attach the city's localized system to the Master Site Switch will be finalized.

By the end of 2010, it is estimated that 55.69 percent of Idaho's population will be served by communications interoperability through the Project 25, 700 MHz radio system installed by County/Regional/Tribal Level and City/Local/Other Level agencies. It is estimated that 30 percent of the State Level agencies will have been interfaced to the 700 MHz radio system. A small percentage of the State Level agencies will be testing mobile and handheld radios on the 700 MHz radio system. Approximately 30 percent of the State Level agencies will be using the wideband data capabilities of the system. Connectivity to federal and other state systems will begin.

In Years 2011 – 2012:

State Level

Districts 2, 4, and 6 will have completed installation of radio equipment on their respective radio sites. All of the major work on the digital microwave system will have been completed in calendar year 2011. Work will continue on bringing the last few County/Regional/Tribal Level and City/Local/Other Level systems on line.

County/Regional/Tribal Level

Regional systems will continue to work toward reaching Level 3 interoperability.

All regions that have completed radio engineering studies and choose to join the 700 MHz radio system or build an interface to the system will begin their budget, procurement, and installation cycles. As they interface or are brought on-line, coordination with the Idaho Department of Administration to attach the regional system to the statewide system through the best method available will be finalized.

City/Local/Other Level

All cities will have completed radio engineering studies. Those choosing to join the statewide interoperable radio system will begin their budget, procurement, and installation cycles. Each city's system will be brought on-line, in coordination with the Idaho Department of Administration, attaching to the statewide system through the best method available.

By the end of 2012, 95 percent of the state's public safety agencies will have had the opportunity to share in the statewide 700 MHz radio system. It is estimated that 80 percent of Idaho's population will be served by communications interoperability through the Project 25, 700 MHz radio system installed by County/Regional/Tribal Level and City/Local/Other Level agencies. Wideband data will become a major reason for all public safety agencies to begin using the 700 MHz radio system.

Connecting to Disparate Radio Systems

Cooperation and coordination has been key since the formation of the SIEC. Public safety representatives from federal, state, local and tribal agencies have been meeting on a monthly

basis to define a method for connecting dissimilar radio systems to the interoperable system. Appendix H, Methodology Of Connecting To The 700 MHz Radio System, defines alternate methods of connecting to the 700 MHz radio system.

Conclusions and Recommendations

Conclusions

The SIEC considered all available alternatives in the ICTAP survey. The survey and other pertinent information reviewed led to the conclusion that a 700 MHz backbone system will best accommodate Idaho's unique needs.

The SIEC is committed to its charge to promote efficient and effective use of resources for matters related to public safety wireless radio interoperability, standing ready to assist in the promotion of coordination and cooperation of a statewide interoperability goal.

This Radio Interoperability Concept begins Idaho's movement toward a tiered radio interoperability system which will provide a statewide standard for radio communications.

Recommendations

To that end, the SIEC recommends that the State of Idaho and its political subdivisions begin immediate planning and implementation of a single Project 25 (P25) infrastructure to serve the communications needs of emergency responders.

The statewide interoperable communications backbone shall be operated in the 700 MHz frequency band.

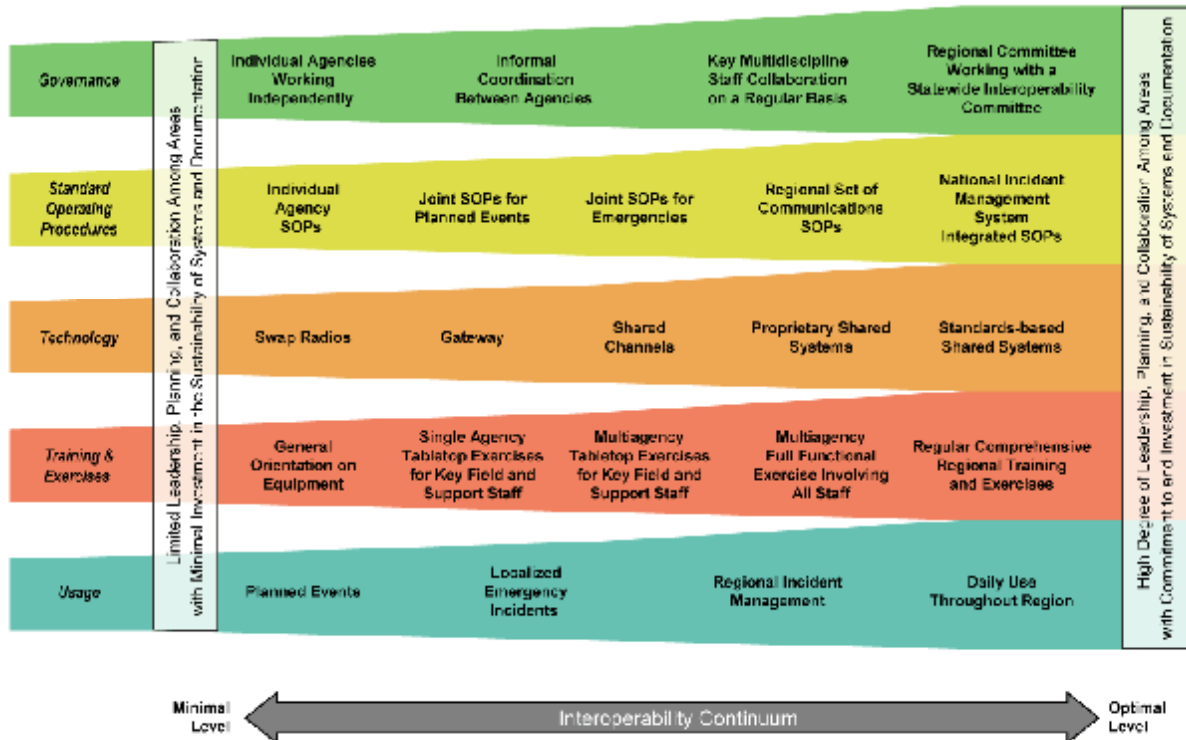
All agencies are highly encouraged to participate in the 700 MHz interoperable radio system.

Appendix A



Homeland
Security

Interoperability Continuum



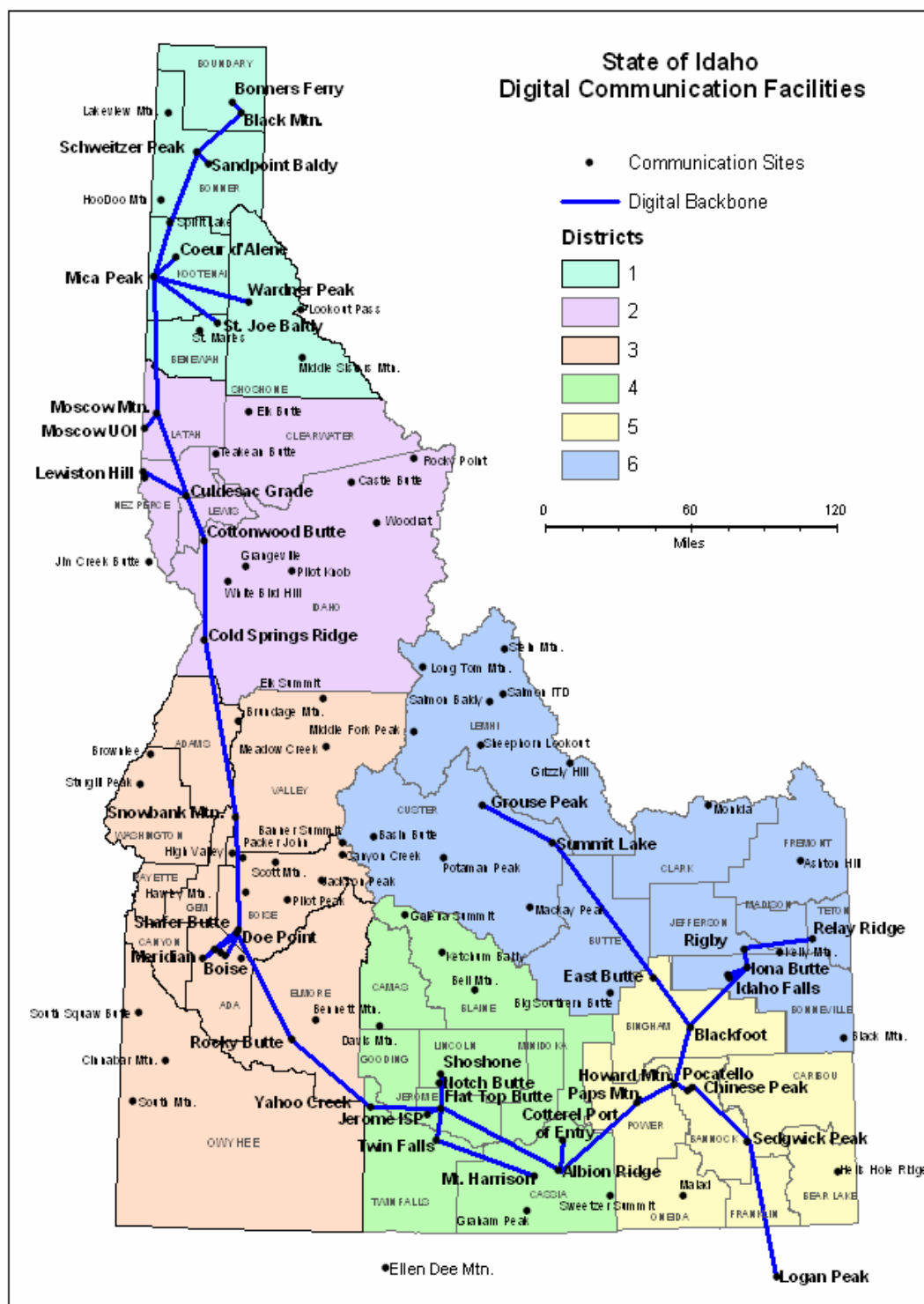
SAFECOM Interoperability Continuum

This Interoperability Continuum is designed to help the public safety community and local, tribal, state, and federal policy makers address critical elements for success as they plan and implement interoperability solutions. These elements include frequency of use of interoperable communications, governance, standard operating procedures, technology, and training/exercises.

The Interoperability Continuum was developed in accordance with SAFECOM's locally driven philosophy and its practical experience in working with local governments across the nation. This tool was established to depict the core facets of interoperability according to the stated needs and challenges of the public safety community and will aid public safety practitioners and policy makers in their short and long term interoperability efforts.

Communications interoperability refers to the ability of public safety agencies to talk across disciplines and jurisdictions via radio communications systems, exchanging voice and/or data with one another on demand, in real time, when needed, and as authorized.

MAP



Appendix C

Resolution

Idaho Statewide Interoperability Executive Council

Resolution Number 2005-01

WHEREAS, the Council has considered all available alternatives; and

WHEREAS, a study conducted by the Interoperable Communications Technical Assistance Program (ICTAP) team concluded that a 700 MHz system was feasible; and

WHEREAS, the ICTAP study and other pertinent information was reviewed by the SIEC Technical Subcommittee; and

WHEREAS, many local governments agencies have received radio engineering studies and have opted to install 700 MHz radio systems; and

WHEREAS, the Federal Communications Commission (FCC) in an attempt to promote migration to narrowband (12.5 kHz) technology in the 150-174 MHz and 421-512 MHz bands by January 1, 2013, released FCC 04-292; and

WHEREAS, there are insufficient channels available in the 150-174 MHz and 421-512 MHz bands to comply with the FCC mandate to migrate to narrow band; and

WHEREAS, there are existing high speed data requirements that can only be realized using a 700 MHz radio versus either the slower data speeds in the 150-174 MHz or 421-512 MHz or the 800 MHz frequency bands; and

WHEREAS, some agencies may elect to remain in the UHF or VHF frequency bands; and

WHEREAS, the 700 MHz backbone system will accommodate those agencies, allowing them to share the benefits of a statewide backbone.

BE IT HEREBY RESOLVED BY THE IDAHO STATEWIDE INTEROPERABILITY EXECUTIVE COUNCIL, that:

1. The statewide interoperable communications backbone shall be operated in the 700 MHz frequency band;
2. All agencies are highly encouraged to participate in the 700 MHz interoperable radio system.

Resolution Rationale

There are numerous reasons for implementing a 700 MHz Trunked Radio system.

- First, a study by the Interoperable Communications Technical Assistance Program (ICTAP) team, a program under the US Department of Homeland Security, was delivered to the Statewide Interoperability Executive Council in December 2004. The purpose of this study was to provide technical assistance in order to determine the feasibility of a 700 MHz statewide communications system. A copy of this study can be provided by the SIEC.
- Second, many local governments agencies have received radio engineering studies and have opted to install 700 MHz radio systems. Copies of these engineering studies should be obtained from the counties that have had engineering studies completed.
- Third, the Federal Communications Commission (FCC) in an attempt to promote migration to narrowband (12.5 kHz) technology in the 150-174 MHz and 421-512 MHz bands by January 1, 2013, released FCC 04-292. In this Third Memorandum Opinion and Order and Third Further Notice of Proposed Rule Making and Order, the FCC in part said, "We also adopt January 1, 2013 as the deadline by which Public Safety Radio Pool licensees operating in the 150-174 MHz and 421-512 MHz bands must migrate completely to 12.5 kHz narrowband technology."
- Fourth, there are very little to no available channels in the 150-174 MHz and 421-512 MHz bands.
- Fifth, there are existing high speed data requirements that can only be realized using 700 MHz versus either the slower data speeds in the 150-174 MHz or 421-512 MHz or the 800 MHz frequency bands.

We recognize that some agencies may elect to remain in the UHF or VHF frequency bands and that the system developed using the 700 MHz backbone will accommodate those agencies and will allow them to share in the benefits of the statewide backbone. The choice to participate is each agencies responsibility, but all agencies are highly encouraged to participate in the 700 MHz interoperable radio system.

Appendix D

700 MHz Radio Survey

The Department of Homeland Security (DHS) Interoperable Communications Technical Assistance Program (ICTAP) was requested by the Idaho SIEC to produce several coverage maps utilizing 700 MHz spectrum. The contour models utilizing set criteria could then be evaluated to determine potential coverage of a 700 MHz system. Forty-nine state microwave sites were selected for the studies based upon trunked radio systems requirement for microwave to operate effectively. Following is the list of criteria that was used as a standard format for the forty-nine site contour models:

1. Tx ERP = 160 Watts
2. Repeater/Base Station Tx Power = 31 Watts⁶
3. Repeater/Base Station Rx Sensitivity = -121 dBm⁵
4. Tx/Rx Connector Loss = 0.5 dB²
5. Tx Combiner Loss (Accounted for in Tx power)⁵
6. Rx Multicoupler Loss (Accounted for in Rx sensitivity)⁵
7. Tx and Rx Antennas = DB589 with a gain of 9 dBd
8. Tx Antenna Height = 70 feet
9. Tx Cable Length = Antenna height + 30 feet (tower base to equipment) = 100 feet
10. Rx Antenna Height = 80 feet
11. Rx Cable Length = Antenna height + 30 feet (tower base to equipment) = 110 feet
12. Tx/Rx ½" Superflex Line Loss = 3.2 dB/100 feet
13. Tx/Rx 1¼" Line Loss = 0.732 dB/100 feet
 - Run ½" Superflex from equipment and tie to 1¼" coaxial (inside building)
 - Run 1¼" Coaxial to antenna on the tower
14. Frequency of operation = 770 MHz for talk out
15. Frequency of operation = 800 MHz for talk in
16. Propagation model is Okumura-Hata-Davidson Adaptive
17. Adaptive parameters: See table below⁷

	Attenuation (dB)
Classification	Frequency (MHz): 746-941
Open Land	5
Agricultural	18
Rangeland	10
Water	0
Forest Land	25
Wetland	3
Residential	20
Mixed Urban/ Buildings	20
Commercial / Industrial	20
Snow & Ice	0

18. Set the confidence and reliability⁸:

⁶ Based on the Motorola STR-3000 data specifications

⁷ Figures from TSB-88B, pg. 96, Table 19

⁸ Figures from TSB-88B, pg. 101, Table 21

- Set Margin = 11.5 dB for 97% tile reliability (standard deviation of 5.6dB)

19. Delivered Audio Quality (DAQ) Levels⁹:

Audio Level	Talk Out (dBm)	Talk In (dBm)	Bin Color
DAQ 4	-105.4	-107.4	Green
DAQ 3.4	-108.9	-110.9	Blue
DAQ 3	-110.1	-112.1	Orange

20. Subscriber Unit: (the receiving mobile unit)¹⁰

- Rx/Tx Omni Antenna Gain = 3 dB
- Rx/Tx Loss = 4 dB
- Rx/Tx Antenna Height = 4 feet
- Transmitter Power = 30 Watts
- Receiver Sensitivity = -119 dBm
- Use 1¼" Coaxial cable rather than ½" coaxial cable.
- Use ½" Superflex coaxial cable rather than ¼" Superflex coaxial cable.
- Use 97% vice 95% tile reliability margin.
- Top mounted antennas with Receiver (Rx) = 80 feet and Transmitter (Tx) = 70 feet rather than using currently available space on existing towers.
- Print maps for each of the 49 sites, one site at a time (talk out and talk in), rather than district wide coverage maps.
- Show coverage maps using MapPoint underlay map rather than a terrain map to show cities and main roads.
- Add Effective Radiated Power (ERP) to the parameter list.

The following list of sites was selected for the study by ICTAP:

District 1

- Black Mtn. / Bonners Ferry
- Bonners Ferry
- Coeur d'Alene
- Mica Peak
- Sandpoint Baldy
- Schweitzer Peak

District 2

- Cold Springs Ridge
- Cottonwood Butte
- Culdesac Grade
- Grangeville
- Lewiston
- Lewiston Hill
- Moscow (U of I)
- Moscow Mtn.

⁹ Reference TSB-88B, pg. 159, Table A-1

¹⁰ Based on the Motorola XTL-5000 data specifications

District 3

- Boise ITD Dist 3
- Boise ITD Hdqtrs.
- Boise Towers
- Brundage Mtn.
- Doe Point
- Meridian
- Rocky Butte
- Shafer Butte
- Snowbank Mt.

District 4

- Albion Ridge
- Cotterel Port of Entry
- Flat Top Butte
- Jerome ISP
- Ketchum Baldy
- Mt. Harrison
- Notch Butte
- Shoshone
- Twin Falls
- Yahoo Creek

District 5

- Blackfoot
- Chinese Peak
- Howard Mtn.
- Paps Mtn.
- Pocatello
- Sedgwick Peak

District 6

- East Butte
- Grouse Peak
- Idaho Falls ISP
- Idaho Falls SOB
- Iona Butte
- Relay Ridge
- Rigby
- Salmon Baldy
- Salmon ITD
- Summit Lake

Appendix E

SUGGESTED PLANNING ELEMENTS FOR COUNTY INTEROPERABLE EMERGENCY COMMUNICATIONS PLANS

Idaho Statewide Interoperability Executive Council (SIEC)

To: Counties of Idaho and SIEC Partners

Subject: Assistance Memorandum on Interoperability Planning

This appendix is presented in support of accomplishing Phase I of the Idaho Cooperative Agencies' Wireless Interoperable Network (I-C-A-WIN). The SIEC believes that most areas will be able to achieve Level 3 interoperability with relatively minor modifications to their existing communications systems. As counties proceed to prepare written communications plans and evaluate the best use of their existing resources, this document may assist in standardizing the necessary information. This should allow the analysis of existing systems and plans for purposes of expanding such to regional and then statewide systems in the next phases of I-C-A-WIN.

This memo provides information and suggests elements for developing a local interoperability communications plan. It is provided by the SIEC as a resource. It is the hope of the SIEC that this information will be a useful starting point for interoperability planning.

For the purposes of coordinating communication agencies, the SIEC recommends including a broad range of public and private entities that provide public safety services, including: emergency management, police, fire, emergency medical service, hospitals, transportation, public works, utilities, forestry, municipal and commercial airports and other state and federal agencies that operate radio systems within a service area.

Suggested Planning Elements County Interoperability Plan

1. Introduction

2. Lead Contact Information

- a. Designation of Lead Agency for Plan
- b. Contact Information for Designated Primary Contact

3. Managers of Radio Systems Within County

- a. List entities and users to be covered by the plan
- b. Identify managers of public safety radio systems in county and contact person(s)

4. Service Area

- a. Describe coverage area and the population served within area
- b. Generally describe the type of topography/terrain of service area
 - i. Roads
 - ii. Waterways
 - iii. Mountains/hills
 - iv. Other
- c. Identify the type of structures that present special challenges within the service area (e.g. tunnels, high rise buildings, industrial complexes)
- d. Provide signal coverage maps as available
- e. Identify dispatch center(s) that dispatch for the public safety agencies within geographic area

5. Frequencies Used and Licensed in County

- a. List frequencies used in the county and the agencies that hold the FCC license
- b. List persons responsible for maintaining licensing of frequencies (FCC compliance)

6. Intergovernmental Agreements

Briefly describe the formal and/or informal communications arrangements that presently exist within the planning area. *Examples:* memoranda of understanding, mutual aid agreements, historical perspective or practice, contract, etc.

7. Status of Interoperability in County

- a. Describe radio communications systems presently in operation within the service area

- i. Frequencies used and band of operation
 - ii. Coverage and reliability (effectiveness)
 - iii. Redundancy of systems
 - iv. Existing user groups and the purpose of each group
 - v. Language and code usage for each user (e.g. 12 code, 10 code or clear text)
- b. Describe what the county has done or has planned to do toward implementation of the NIMS as requested by the Federal Department of Homeland Security. Include a description of the ICS portion of NIMS to be incorporated in the county communications plan.
 - i. Describe the daily use of channels for responses to incidents.
 - ii. Describe how current and planned channels will be implemented in the ICS system for major events.
- c. Interoperability within the county
 - i. Describe known interoperability gaps and challenges
 - ii. Identify actions in progress to address short- and long-term problems and provide associated timeline for completion
 - iii. Identify gaps and challenges that cannot be addressed at this time
 - iv. Identify or describe plans to conduct, or results of, any emergency management training exercises that test communications within the county
 - v. Identify existing communications plans, if any, of system users including on-going plans to develop the communications infrastructure
- d. Interoperability outside the county
 - i. Identify how the county and planning partners will improve interoperability with neighboring counties within the state and, if applicable, with neighboring counties in border states
 - ii. Identify what the county and planning partners are doing to improve interoperability with state public safety entities
- e. Short-term interoperability
 - i. Describe what the county and planning partners have done or have planned to implement the Federal Communications Commission's newly established nationwide interoperability channels¹¹
 - ii. Describe plans, if any, and processes to transition to narrow band and digital operations, consistent with FCC Project 25 Standards

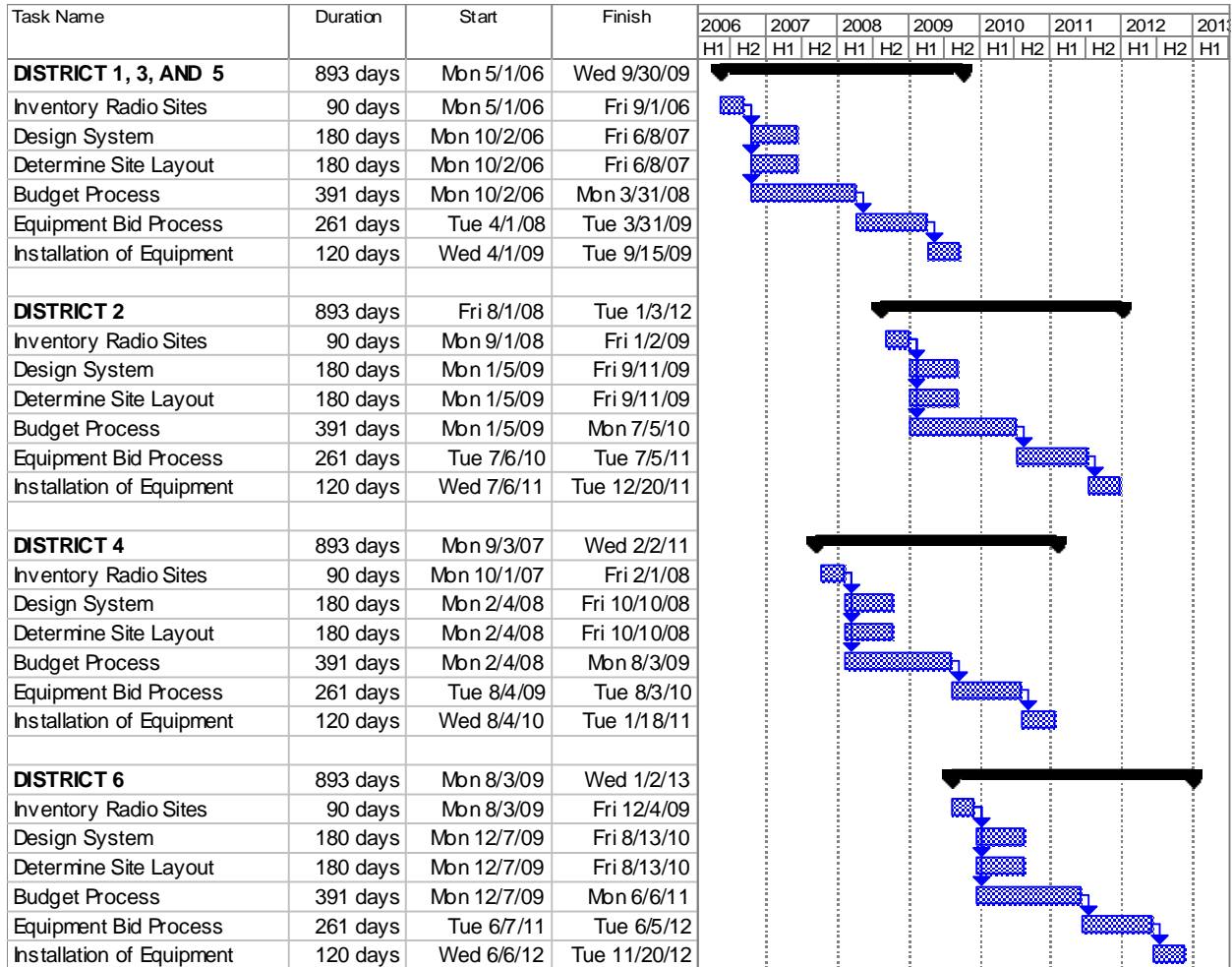
¹¹ The following is the SIEC's guide for programming the FCC designated interoperability (I/O) channels into existing radios and all new radios that are added to any system. Due to space limitations in some radios, it may not be possible to program all of the I/O channels into all radios. In that case, at a minimum, the calling channel and the first tactical channel should be programmed. The frequencies listed are in each of the -3 bands and are listed by order of priority, with the highest priority shown at the top of the list. They are to be programmed into the radios with the highest priority first, as space permits. Details of those channels can be found at: http://egov.oregon.gov/SIEC/docs/SIEC_Publications/SIEC_Interoperability_Guide_12_04.pdf

Resources

- <http://egov.oregon.gov/SIEC/>
- http://egov.oregon.gov/SIEC/docs/ShortTerm_Rec_09_07_2004.pdf
(Short Term Plan for Interoperability)
- http://egov.oregon.gov/SIEC/docs/ShortTerm_Rec_09_07_2004.pdf
(CJSD Grant Application). Minimal Level – Optimal Level Interoperability in Appendix A at page 17.)
- <http://www.doj.usdoj/odp/docs/bulletins.htm>

Appendix F

State Agency Timeline



Legend:

H1, H2 = Half Year 1, Half Year 2

Appendix G

Budgetary Estimate For A Wide Area Trunking Solution

The short- and long-term budget strategies will be developed late 2005 and will not include budgetary estimates for local/county/tribal agencies.

Samples to serve as models may be obtained by contacting:

Lt. Bart Hamilton
Ada County Sheriffs Office
208.377.6652

Or

Gordon Howell
Chief Technical Officer
Bannock County
208.236.7389

Appendix H

Methodology Of Connecting To The 700 MHz Radio System.

The following table sets the rules that allow other than 700 MHz radio systems to connect to the 700 MHz radio system in this plan

<u>Technology Used</u>	<u>Frequency Band</u>	<u>Interoperability/Connectivity</u>
P 25 Trunking	All	Master Site
P 25 Conventional	All	Master Site if Connected
P 25 Conventional	All	ACU1000 LYRIX Console Patch Gateway Device If not connected to the Master Site
Conventional	All	ACU 1000 LYRIX Console Patch Gateway Device

This publication was supported by grant # 2004-GE-T4-0034 awarded by the Idaho Bureau of Homeland Security. Points of view or opinions in this document are those of the authors and do not represent the official position or policies of the U.S. Department of Homeland Security or the Idaho Bureau of Homeland Security. Costs associated with this publication are available from the Idaho Statewide Interoperability Executive Council in accordance with I.C. Section 60-202.

For more information about this document or to submit comments please contact the Idaho Statewide Interoperability Executive Council at 208.884.7210 or e-mail Sandy Harris at sandy.harris@isp.idaho.gov